



**Public Water Supply
Survival Guide
For the
Revised Total Coliform Rule**

Kansas Department of Health and Environment
Bureau of Water, Public Water Supply Section
1000 SW Jackson, Suite 420
Topeka, Kansas 66612-1367

2017

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OVERVIEW

This guidance document is provided by the State of Kansas as a “quick reference guide” to assist Public Water Supply (PWS) Systems in complying with the Revised Total Coliform Rule (RTCR) requirements contained in the Kansas Primary Drinking Water Regulations. It presents a summary of the applicable regulatory requirements associated with the RTCR made effective by the Environmental Protection Agency (EPA) on April 1, 2016, which has been primarily adopted by the Kansas Department of Health and Environment (KDHE). This guidance provides a summary of the applicable requirements which must be met. It is a basic “what and when” summary for all public water systems. While all systems should feel comfortable using this document as a complete and accurate summary of RTCR requirements, the applicable full legal language is contained in the Kansas Administrative Regulations in conjunction with the Code of Federal Regulation which KDHE has adopted by reference.

This survival guide applies to:

Systems: Community, Non-Transient Non-Community, Transient Non-Community Water Supplies

Sources: All source types

Persons Served: All population groups served by a PWS

Treatment: All treatments

Specific questions regarding the information contained in this document, the Kansas Primary Drinking Water Regulations, or any other matters pertaining to drinking water and public water supply systems in Kansas should be directed to:

Kansas Department of Health and Environment
Bureau of Water, Public Water Supply Section
1000 SW Jackson, Suite 420
Topeka, Kansas 66612-1367
Phone: (785) 296-5514
Fax: (785) 559-4258

Additional information and e-mail addresses can be obtained by accessing KDHE’s web site at:

<http://www.kdheks.gov/pws/contactus.html>

With the exception of the KDHE policies described in Section 5, reference is made to EPA guidance documents for specific details. Full citations to EPA manuals are given in the preface, along with shortened names by which these publications are identified whenever they are cited in this “Survival Guide.” KDHE staff, public water supply system officials, and other interested parties can refer to these documents when examining the specific details of the Revised Total Coliform Rule.

ACRONYMS

ACC - Alternative Compliance Criteria
BAT - Best Available Technology
KDHE - Kansas Department of Health and Environment
CC – Consecutive Connection
CFR - Code of Federal Regulations
CWSS - Community Water Supply System
D/DBP - Disinfectants and disinfection byproducts
D/DBPR - Disinfectants and Disinfection Byproducts Rule
DBPs - Disinfection Byproducts
DBPP - Disinfection Byproducts Precursor
DOC - Dissolved Organic Carbon
EPA - United States Environmental Protection Agency
GWR – Groundwater Rule
GWUDI - Ground water under the direct influence of surface water
HAA5 - Sum of five haloacetic acids which are a byproduct of disinfection
MCL - Maximum Contaminant Level
MCLG - Maximum Contaminant Level Goal
mg/L - Milligrams per liter or parts per million (ppm)
MRDL - Maximum Residual Disinfectant Level (as mg/L)
MRDLG - Maximum Residual Disinfectant Level Goal
NCWS - Non-Community Water System
NTNCWSS - Non-Transient Non-Community Water Supply System
PWSS - Public Water Supply System
SDWA - Safe Drinking Water Act
SOP - Standard Operating Procedure
TWSS - Transient Non-Community Water Supply System
TOC - Total Organic Carbon
TTHMs - Total trihalomethanes which are byproducts of disinfection
µg/L - Micrograms per Liter or parts per billion (ppb)

DEFINITIONS

Bacteria: one-celled microorganisms. Some are useful and some cause disease in plants, animals and humans.

Coliform: bacteria which inhabit the intestinal tract of man and other animals. The coliforms include: *E. coli*, *Klebsiella*, *Enterobacter*, *Citrobacter*, and may include *Serratia* and *Edwardsiella*. They are normally free-living and may be found in many areas of the environment including in soil, on plants, wood, leather, etc.

E. coli: *Escherichia coli*; a rod-shaped bacterium normally occurring in mammalian [human and animal] intestinal tracts. *E. coli* is more specific to the mammalian gut than other members of the coliform group.

EPA: The United States Environmental Protection Agency has federal oversight responsibility and authority regarding the administration and enforcement of the Safe Drinking Water Act. EPA prepares rules and technical / implementation guidance to implement the Safe Drinking Water Act through other agencies with primacy authority such as KDHE.

Fecal: related to the bodily waste material formed in the large intestine and eliminated from the body through the anus.

KDHE: The Kansas Department of Health and Environment is Kansas' primacy agency for the administration of the Safe Drinking Water Act. When the term "the State" is used in this survival guide, it refers to this agency.

GWR: The Groundwater Rule, promulgated by EPA on November 8, 2006 and effective December 1, 2009, applies to all systems which use groundwater except those which combine all of their groundwater with surface water or with groundwater under direct influence of surface water prior to treatment. The RTCR and GWR have interrelated provisions; actions initiated under the RTCR have the potential to effect compliance under the GWR. The GWR requires systems which use their own or purchase groundwater from another PWS through a CC and which have a coliform-positive routine RTCR sample from their distribution system to sample each groundwater source for *E. coli*. This is called triggered source water monitoring. Systems which provide 4-log removal treatment and report monthly to the State may avoid having to do the triggered source water monitoring.

GWUDI: Systems utilizing "groundwater under the direct influence of surface water" (as previously determined by KDHE) are required to treat water from these sources as specified under the Surface Water Treatment Rule.

MCL: Maximum contaminant levels specify upper limits on the concentration of drinking water contaminants established in Kansas Primary Drinking water Regulations.

M/DBP Rules: The term "M/DBP Rules" stands for "Microbial / Disinfection Byproduct Rules" and refers to the RTCR, SWTR, IESWTR, LT1ESWTR, LT2ESWTR, Stage 1 DDBPR, Stage 2 DDBPR, FBRR, and GWR collectively.

PWSS: A public water supply system means a system for the provision to the public of water for human consumption through pipes or other constructed conveyances, if the system has at least 10 service connections or regularly serves an average of 25 individuals daily at least 60 days out of the year. This includes collection, treatment, storage and distribution facilities used in connection with the system. All public water supply systems are either a “community water supply” or “non-community water supply” system.

RTCR: The Revised Total Coliform Rule, is the revised version of the Total Coliform Rule, which was a precursor to enhanced requirements established under the Interim Enhanced Surface Water Treatment Rule, the Stage 1 Disinfectants and Disinfection Byproducts Rule, and the Groundwater Rule. The RTCR establishes health goals and legal limits for total coliform levels in drinking water (as indicator organisms), requires the conduct of routine sanitary surveys of systems, and specifies the type and frequency of testing which systems must perform.

Stage 1 DDBP Rule: The Stage 1 Disinfectants and Disinfection Byproducts Rule, promulgated by EPA on December 16, 1998, is a companion rule to the Interim Enhanced Surface Water Treatment Rule. The Stage 1 DDBP Rule established enhanced requirements on the monitoring and treatment of disinfectants and disinfection residuals in system distribution systems. These two rules have interrelated provisions; actions initiated under one rule have the potential to effect compliance under the companion rule.

Subpart H System: public water supply systems which are supplied by either surface water or ground water under the direct influence of surface water.

SWTR: The Surface Water Treatment Rule, promulgated by EPA on June 29, 1989, was the precursor to enhanced requirements established under the Interim Enhanced Surface Water Treatment Rule and the Stage 1 Disinfectants and Disinfection Byproducts Rule. It established filtration and disinfection requirements that provide for continuous protection from pathological microbes potentially present in source waters.

THE REVISED TOTAL COLIFORM RULE

Implementation

The Environmental Protection Agency (EPA) issued revisions to the National Primary Drinking Water Regulations which were finalized in June 1989 and were known as "The Total Coliform Rule". EPA revised this rule, and on April 1, 2016, the "Revised Total Coliform Rule" was implemented.

Summary of Compliance with Maximum Contaminant Levels

1. The maximum contaminant level (MCL) for microbiological contaminants is based on the presence or absence of total coliforms in a sample, rather than coliform density.
2. Each public water system is required to determine compliance with the MCL for total coliforms in each month in which it is required to monitor.
3. Systems which collect at least 40 samples a month are in compliance if no more than 5.0 percent of the samples collected (including all routine and repeat samples) during a month are total coliform-positive.
4. Systems which collect fewer than 40 samples a month are in compliance if no more than one sample collected during a month is total coliform-positive.
5. An *E. coli* MCL violation is incurred with any of the sample result combinations shown in this table (TC+ = total coliform positive; EC+ = *E. coli* positive)

Routine sample	Repeat sample
EC+	TC+
EC+	Any missing sample
EC+	EC+
TC+	EC+
TC+	TC+ (but no <i>E. coli</i> analysis)

6. The Environmental Protection Agency has stated "the best technology, treatment techniques or other means available for achieving compliance with the MCL for total coliforms is:
 - a) Protection of wells from contamination by coliforms by appropriate placement and construction; (see GWR)
 - b) Maintenance of a disinfectant residual throughout the distribution system;
 - c) Proper maintenance of the distribution system including appropriate pipe replacement and repair procedures, main flushing programs, proper operation and maintenance of storage tanks and reservoirs, and continual maintenance of positive water pressure in all parts of the distribution system;
 - d) Filtration and disinfection of surface water, and disinfection of ground water using strong

oxidants such as chlorine, chlorine dioxide, or ammonia.

7. Each system which exceeds the MCL for *E. coli* is required to provide public notice to its customers according to the Public Notification Rule. Groundwater systems or systems which purchase groundwater are also required to do triggered source water monitoring or otherwise comply with the GWR, in the event of a total coliform positive routine sample.

Summary of Compliance with Monitoring

1. Routine monitoring

- a) Systems shall collect total coliform samples at sites which are representative of water throughout the distribution system.
- b) Systems shall have a written sampling site plan. If there is only one service connection, the plan should state so and identify the representative site or sites.
- c) Systems shall collect samples at regular time intervals throughout the month from different sites, unless they have only one service connection site from which to sample. Groundwater systems which serve 4,900 or fewer people and are not under the direct influence of surface water as defined in 40 CFR 141.2 may collect all required samples on a single day from different sites.
- d) Frequency of monitoring is a **minimum of four times a month for surface water systems serving 4,100 or fewer people**. Surface water systems serving greater than 4,100 people and systems which use ground water or purchased treated water shall sample at the frequency based on the population served. Non-community and small community public water supply systems shall sample no less than two times a month.

2. Repeat monitoring

- a) If a routine sample is total coliform-positive, the sample shall be analyzed for *E. coli* or fecal coliform, and the public water system shall collect a set of three (3) repeat samples within 24 hours of learning of the positive result. The state may extend the 24-hour limit on a case by case basis if logistics prevent meeting that time limit. A system which collects more than one coliform-positive routine sample a month shall collect no fewer than three repeat samples for each total coliform-positive routine sample. Failure to collect any repeat sample following a total coliform positive routine sample is a monitoring violation, and may result in the requirement to perform a Level 1 Assessment. Failure to collect any repeat samples following an *E. coli* positive routine sample is a violation of the *E. coli* MCL.
- b) At least one repeat sample shall come from the original coliform-positive tap. One repeat sample shall come from a site within five service connections upstream (or above) and one from a site within five service connections downstream (below) of the original sample site.
- c) If a total coliform-positive sample is at the end of the distribution system, or one away from the end of the distribution system, the system may collect one repeat sample from the original tap, one from one service connection upstream and the third repeat sample from a

site within five service connections upstream of the original sample.

- d) The system shall collect all repeat samples the same day. However, a non-community with only one service connection may collect all 3 samples on the same day (300 ml total) or collect one sample (100 ml) a day for 3 consecutive days.
- e) If one or more repeat samples is total coliform positive, following a total coliform positive routine, and if the water system routinely collects less than 40 samples per month, a Level 1 Assessment is triggered. If the water system routinely collects 40 or more samples per month, and 5 percent or more of the results of all routine and repeat samples in a month are total coliform positive, a Level 1 Assessment is triggered.
- f) A system which collects fewer than five routine samples a month and which had one or more total coliform-positive samples which have not been invalidated shall collect at least five routine samples the next month the system provides water to the public.
(Temporary Routine Schedule)
- g) Results of all routine and repeat samples which have not been invalidated are to be used to determine compliance with the RTCR.
- h) Each water system which fails to monitor is required to issue public notification.

3. Invalidation of total coliform samples

- a) A total coliform sample which has been invalidated does not count toward meeting the monitoring requirements.
- b) The state may invalidate a sample only upon written request of the water system signed and approved by a state official and that person's supervisor.
- c) Invalidation may only be made if the following conditions are met:
 - i) The laboratory acknowledges a procedural error invalidated the results.
 - ii) The state determines that the total coliform-positive sample resulted from a domestic or other non-distribution-system plumbing problem.
 - iii) The state has substantial reason to believe a total coliform-positive result is due to a circumstance or condition which does not reflect water quality in the distribution.
- d) The state may not invalidate a total coliform-positive sample solely on the basis that all repeat samples are total coliform-negative.
- e) A laboratory shall invalidate a total coliform sample if the sample:
 - i) produces a turbid culture in the absence of gas production using the MPN method;
 - ii) produces a turbid culture in absence of an acid reaction in the P-A coliform test; or

- iii) exhibits confluent growth or produces colonies too numerous to count in the membrane filter test.
- f) Samples which are invalidated shall be replaced by collecting another sample from the same location within 24 hours of learning of the invalidation.

4. Analytical methodology

- a) The standard sample volume required for total coliform analysis is 100 ml. Bottles supplied by the Kansas Health and Environmental Laboratory should be filled to between the 100 mL line and the 120 mL line on the bottle.
- b) Public water systems need only determine presence or absence of total coliforms; a determination of coliform density is not required.
- c) Analytical methods are as set forth in Standard Methods for the Examination of Water and Wastewater. Any questions about analytical methodology should be referred to the Environmental Microbiology Laboratory at (785) 296-0971.

NUMBER OF SAMPLES REQUIRED BY POPULATION GROUP

For surface water systems serving $\leq 4,100$ the minimum number of samples per month is 4.

<u>Population served</u>	<u>Minimum number of samples/month</u>
25 to 2,500.....	2
2,501 to 3,300.....	3
3,301 to 4,100.....	4
4,101 to 4,900.....	5
4,901 to 5,800.....	6
5,801 to 6,700.....	7
6,701 to 7,600.....	8
7,601 to 8,500.....	9
8,501 to 12,900.....	10
12,901 to 17,200.....	15
17,201 to 21,500.....	20
21,501 to 25,000.....	25
25,001 to 33,000.....	30
33,001 to 41,000.....	40
41,001 to 50,000.....	50
50,001 to 59,000.....	60
59,001 to 70,000.....	70
70,001 to 83,000.....	80
83,001 to 96,000.....	90
96,001 to 130,000.....	100
130,001 to 220,000.....	120

220,001 to 320,000.....	150
320,001 to 450,000.....	180

For each additional 150,000 in population, an additional 30 water samples shall be analyzed per sampling period.

**SAMPLING SITE PLAN FOR
BACTERIOLOGICAL SAMPLES**
(for systems which have more than one service connection)

K.A.R. 28-15a-21, adopting 40 CFR 141.21 (a) by reference, requires total coliform samples to be collected “at sites which are representative of water throughout the distribution system according to a written sample siting plan. These plans are subject to State review and revision.” Below is a recommended way to develop a written sampling plan in order to assure coverage of the system.

1. Prepare a map of the distribution system.
2. Divide the map into the same number of zones that there are bacteriological samples required each month (ex. two routine samples a month requires two zones to be sampled).
3. Select five sampling locations (sites) for collecting the samples in each zone. The sites chosen should be representative of the service connections in that area.
4. Prepare a list of all the sampling locations including zone and address. Each year, five different sampling locations should be chosen in each zone.
5. For routine sampling each month, rotate through the sampling sites and collect one in each zone.
6. **Failure to prepare and follow a sample-siting plan is a violation of K.A.R. 28-15a-21 and can result in a requirement to issue public notification.**
7. Site plans should be available for review upon request.

If there are any questions, please call the Kansas Department of Health and Environment in Topeka at (785) 296-5518 or the KDHE district office closest to your location.

Northeast District – Lawrence (785) 842-4600
North Central District – Salina (785) 827-9639
Northwest District – Hays (785) 625-5663
Southeast District – Chanute (620) 431-2390
South Central District – Wichita (316) 337-6020
Southwest District – Dodge City (620) 225-0596

ENVIRONMENTAL MICROBIOLOGY
Kansas Department of Health and Environment
Kansas Health and Environmental Laboratory
6810 SE Dwight Street
Topeka, KS 66620

Directions for Collection of Water Samples

1. **Use only sterile bottles** furnished by the Environmental Microbiology Section. Keep bottles sealed until used. Please return unused bottles.
 2. **Collect samples from rigid faucets when possible.** Do not collect from: water softeners, charcoal filters, yard hydrants, fire hydrants, frost-free hydrants, leaking faucets, hot water faucets, sill cocks. Try to avoid swing or swivel faucets or single handle faucets whenever possible.
 3. **Do not collect all samples from the same site unless there is only one service connection in your system.**
 4. **Remove any aerator or filters** from faucet if possible before sampling.
 5. Wash hands before beginning sampling procedures. **Run the water** at a steady rate (so it doesn't splash out of the bottle) **for 3 to 5 minutes** before sampling. Do not adjust flow.
 6. Remove the bottle lid just before filling. Do not rinse out the bottle. Holding the lid in your free hand, **fill the bottle to between the 100 mL line and 120 mL line without letting the water splash out or overflow the bottle.** Then replace the lid and tighten securely. Dry the outside of the bottle before packing.
 7. **FILL OUT THE INFORMATION ON THE SAMPLE SUBMISSION FORM:**
Please print all information clearly, using blue or black ink.
 - a. Collection date
 - b. Collector's first and last name
 - c. Time of collection (military time, **24 hour clock, or include a.m. or p.m.**)
 - d. Collection location (brief name, address, or site zone and number)
 - e. Chlorine residual (circle "**Free**", or "**Total**" if combined) (**REQUIRED to be recorded with total coliform samples for determining MRDL under the DBP Rule**)
 - f. Comments that would be helpful
- EPA requires calculation of holding time to be the time between sample collection and sample analysis, and must not exceed 30 hours.
8. Collection of the sample in the afternoon may reduce the holding time. The holding time (from sample collection to initiation of analysis) must not exceed 30 hours. **Collect and ship samples on Monday, Tuesday, or Wednesday unless there is a holiday in the week.** Avoid having the samples arrive at the laboratory on weekends or holidays.
 9. **Collect and return a sample in each bottle** received for your water system. Samples not collected during a month will result in a monitoring violation.
 10. Three repeat sampling bottles and submission forms are sent if there has been a total or fecal coliform found. One routine replacement sampling bottle and submission form are sent if a sample is rejected. Failure to return REPEAT or REPLACEMENT samples will result in monitoring violations. **Empty returns for any reason must be documented** (note or "Comments" section), or a monitoring violation will result.

11. If you have questions about laboratory reports or procedures, call (785) 296-0971.

TEMPORARY ROUTINE SAMPLES

According to Kansas Administrative Regulation (K.A.R.) 28-15a-21, adopting 40 CFR 141.21(b)(5) by reference, a system collecting fewer than five routine samples a month, which has one or more total coliform-positive sample, must collect at least five routine samples during the next month. The additional routine sample(s) should be collected according to the system's bacteriological sampling site plan, just like the other regular monthly samples. **Failure to collect at least five routine samples in the month following receipt of a coliform-positive regular sample will result in a monitoring violation.** The three repeat samples required as soon as possible following a coliform-positive result are a separate requirement and do not cancel the need for the five routine samples in the next month.

INVALIDATION OF SAMPLE(S)

According to K.A.R. 28-15a-21, adopting 40 CFR 141.21(c)(1)(ii) by reference, the State may invalidate a water sample [when] "based on the results of repeat samples, it determines that the total coliform-positive sample resulted from a domestic or other non-distribution system plumbing problem; or ...the total coliform-positive sample is due to circumstances or a condition which does not reflect water quality in the distribution system." The decision with the rationale for the decision must be documented in writing and approved and signed by the supervisor of the State official who recommended the decision to invalidate. **Total coliform-positive samples shall not be invalidated solely on the basis that all repeat samples are total coliform-negative or if the public water system has only one service connection.**

INTERFERENCE IN COLIFORM ANALYSIS

Interference in coliform analysis by heterotrophic plate count (HPC) bacteria occurs in cases where analysis of total coliforms produces the following:

- A turbid culture in the absence of gas production using the multiple-tube fermentation technique.
- A turbid culture in the absence of an acid reaction using the presence-absence technique.
- Confluent growth or produces colonies too numerous to count using the membrane filter technique.

If interference occurs, 40 CFR 141.21(c)(2) requires the laboratory to invalidate a total coliform sample (unless total coliforms are detected) or [the system shall] resample from the same location within 24 hours of being notified of the interference problem, or as directed by the State on a case by case basis.

BACTERIOLOGICAL SAMPLING HOLIDAY SCHEDULE

The number of routine samples required each month is based on population and water source. **No system will collect fewer than two (2) samples a month.** In the month following a coliform-positive sample, no fewer than five (5) regular samples are required (Temporary Routine schedule). All routine, replacement and repeat samples are used to determine compliance with the sampling frequency and bacteriological quality regulations for drinking water.

STATE AND FEDERAL HOLIDAYS WHICH MAY CAUSE MAIL DELAYS

**New Years Day
Presidents Day
4th of July
Columbus Day
Thanksgiving**

**Martin Luther King
Memorial Day
Labor Day
Veterans Day
Christmas**

K.A.R. 28-15a-33 adopting 40 CFR 141.33 by reference requires sample collectors to keep records of the date, place, time of sampling, and the name of the collector of each sample. A back-up sample collector shall be appointed if the regular collector is ill or on vacation.

Water sample kits are sent out monthly to be collected Mondays, Tuesdays or Wednesdays. If there are problems or concerns about the mailing containers, bottles or forms, about reports or bacteriological results of analyses, or if you have not received your bottles by the **10th** of the month in which the sample is to be collected, please call (785) 296-0971. Bottles remain sterile unless opened or damaged. Replacements, if needed, will be mailed first class or UPS as quickly as possible. If you have questions about the sampling requirements or compliance with regulations, call the Public Water Supply Section at (785) 296-5518. To change your shipping address or contact person, please call (785) 296-6340 or (785) 296-7111.

E-mail www.kdheks.gov/pws/

DISINFECTION WITH CLOROX

The following formula can be used to calculate the amount of Clorox (or other bleach containing 5.25% by wt. sodium hypochlorite) necessary to produce a given dosage in a known volume of water.

$$b = VC (2.58 \times 10^{-3}) \text{ or } VC/387$$

where: b = fluid ounces of bleach
 V = volume of water in gallons
 C = desired dosage in ppm or mg/L

387 ppm is the approximate concentration produced by one fluid ounce of Clorox in one gallon of water.

Example: Add 3 ppm to 1200 gallons of water

$$b = (3 \times 1200)/387 = 9.3 \text{ fluid oz. or approximately } 1 \frac{1}{4} \text{ cups}$$

1 pint	=	2 cups	=	16 ounces
1 cup	=	8 ounces	=	16 tablespoons (T)
2 ounces	=	1 T	=	3 teaspoons

DRINKING WATER DISINFECTION REQUIREMENTS

Kansas Administrative Regulation (K.A.R.) 28-15-19 requires “all drinking water supplied to the public from a public water supply system shall be disinfected.” When chlorination is employed, it requires maintenance in the distribution system of at least **0.2 mg/L free chlorine** or **1.0 mg/L of combined chlorine**. Each day the public water supply system serves water to its customers, the operator shall make a determination of the chlorine residual, and the data shall be recorded.

K.A.R. 28-15-19 requires at least 95% of the readings each month to comply with the above minimums. A violation of this regulation occurs when, during any two consecutive months, the required minimums are not maintained in more than 5% of the readings taken each month. These revisions to K.A.R. 28-15-19 went into effect September 26, 1994.

A *Daily Chlorine Residual Log* sheet can be used for tracking the daily readings.

DAILY CHLORINE RESIDUAL LOG SHEET

PUBLIC WATER SUPPLY _____

FOR THE MONTH OF _____, 20__

DATE	TIME	SAMPLE LOCATION	RESULT (mg/L)	INITIALS
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
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26				
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28				
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31				

Water Bacteriology Frequently Asked Questions

Q. I missed my collection day. What do I do?

Please take your sample on the next Monday, Tuesday, or Wednesday that does not fall on or around a holiday. **The sample must be collected within the scheduled month.**

Q. Can you test my well?

The Kansas Health and Environmental Laboratories (KHEL) discontinued coliform testing of private well samples on August 1, 1989. Assuring the safety of private drinking water supplies really requires an assessment of the well location and construction as well as a site assessment for potential contaminants. For example, a poorly constructed well could be free of contaminants one day and then become highly contaminated the next after a heavy rainstorm washed contaminants into the well. Testing a single sample analysis is not a true indicator of the overall safety or purity of the water.

A list of private labs to sample well water or Cryptosporidia, or Giardia, can be found at www.kdheks.gov/envlab/disclaimer.html.

Q. What about water supply address or personnel changes?

Make sure that you keep these up to date at all times. If there are any changes please make sure that the Public Water Supply Section (PWSS) is notified at (785) 296-6340 or (785) 296-7111. The lab prepares kits for mailing about 4 weeks ahead of the collection date, so it is very important that you update your information as soon as possible. You can also print off a [PWS Contact Change Form](#) on the KDHE, Bureau of Water, Public Water Supply Section website:

<http://www.kdheks.gov/pws/documents/ContactInfoUpdateForm.pdf>, and return it to:

Kansas Department of Health & Environment
Public Water Supply Section, Bureau of Water
1000 SW Jackson St, Suite 420
Topeka KS 66612-1367

Q: How does the Lab mail out the collection kits?

If your water system collects 6 or fewer routine samples per month, they are mailed from the KDHE lab to you via the US Post Office on or around the 15th of the previous month.

If you collect 7 or more routine samples per month they are mailed to you via UPS on or around the 20th of the previous month. Your kits should arrive to you around the 1st of the month.

If you do not receive your collection kits by the 10th of the month, call (785) 296-0971 for a replacement.

Q: How do I handle collection kits that are delivered while I still have bottles to collect?

Pay close attention to the date of collection on the submission forms. KHEL sends the bottles out 10 -15 days early, and they can arrive in the month previous to the collection date. If you collect this bottle before the designated collection month, you will have collected too many samples in one month and not enough the next month and you will be out of compliance for the next month.

Q: What can I do if I have sent my sample, but forgot to fill out the collection card?

If the date, time, collection location, chlorine residual, or the collectors name is missing, we will call you one time using the number we have on file. We will leave a message with the clerk, secretary or answering service for you to call us. You will have 24 hours to return the call, then we will reject the sample (for missing information) and send you a replacement ("REPL") kit for you to collect another sample.

If you realize that you left off information after sending your sample, you can call the lab at

(785) 296-0971, and we can update your form when the sample arrives at the lab.

Q: What if there is a small amount of liquid or white powder in the bottle. Is it safe to use?

Yes. The manufacturer adds sodium thiosulfate to each bottle prior to sterilization. Depending on the environmental conditions, the sodium thiosulfate could be liquid droplets or dry out and leave a powder. The sodium thiosulfate removes the chlorine from the sample and works in either liquid or powder form.

Q: What should I do if the lid on the bottle is loose?

If the cap is loose but the safety seal is still intact, then the bottle should be OK! If the lid has fallen off, or you have a concern about the bottle integrity, then call (785) 296-0971 for a new bottle.

Q. I had a positive sample and sent in a box of 3 Repeat samples, and now I have another box of 3 samples, what are they for?

If you have Total Coliform or E. coli detected in a routine water sample:

- The first box of 3 samples are "Repeat" ("RP") samples. Look for the **"REPEAT"** or **"RP"** on the sample submission forms at the top of the form.

- The next set of samples are "Temporary Routine" (TR) samples. Look for the **"TEMPORARY ROUTINE"** or **"TR"** on the sample submission forms at the top of the form. The Temporary Routine (TR) samples should be collected the month following a positive sample. You must collect no fewer than 5 samples the month following a positive routine sample. The number of TR samples you receive is based on how many routine samples you collect each month. If you collect two routine samples a month, you will receive 3 TR samples to bring your total collections for the next month to five (5). If you collect three routine samples a month, you will receive 2 TR samples to bring your total collections for the next month to five (5), etc.

The Temporary Routine samples will be mailed on or around the first of the month in which they are to be collected. They can be collected anywhere on your site plan and collected as you would a routine sample. It is advised to collect them throughout the month on a Monday, Tuesday or Wednesday not preceding a holiday. They must all be returned to the lab by the end of the scheduled month. **Failure to collect and return five routine samples in a month following a positive routine sample will result in a monitoring violation.**

Q. I collected my sample but forgot to mail it, or I know my sample will be too old.

Please call the lab at 785-296-0971, and we will send a replacement if needed. We would like to have the submission form for our records, so we ask that you send it in with your next sample.

Q. Where do I take the replacement for my rejected sample?

You may take it at any place on your registered site plan, but it is good practice to collect it at the original location.

PUBLIC NOTIFICATION REQUIREMENTS
FOR VIOLATIONS OF THE
REVISED TOTAL COLIFORM RULE

Instructions for Fecal Coliform or E. Coli Notice

Example on Next Page

Since exceeding the fecal coliform or *E. coli* maximum contaminant level is a Tier 1 violation, you must provide public notice to persons served as soon as practical but within 24 hours after you learn of the violation (40 CFR 141.202(b)). During this time, you must also contact your primacy agency. You should also coordinate with your local health department. You may also have to modify the template if you also have high nitrate levels or other coliform MCL violations. You must use one or more of the following methods to deliver the notice to consumers (40 CFR 141.202(c)):

- ☐ Radio
- ☐ Television
- ☐ Hand or direct delivery
- ☐ Posting in conspicuous locations

You may need to use additional methods (e.g., newspaper, delivery of multiple copies to hospitals, clinics, or apartment buildings), since notice must be provided in a manner reasonably calculated to reach all persons served.

The notice below is appropriate for hand delivery or a newspaper notice. However, you may wish to modify it before using it for a radio or TV notice. If you do, you must still include all required elements and leave the health effects language in italics unchanged. This language is mandatory (40 CFR 141.205(d)). If you post or hand-deliver notices, print them on letterhead if possible.

Population Served

Make sure it is clear who is served by your water system--you may need to list the areas you serve.

Corrective Action

In your notice, describe corrective actions you are taking. Listed below are some steps commonly taken by water systems with fecal coliform or *E. coli* violations. Use one or more of the following actions, if appropriate, or develop your own:

- ☐ We are chlorinating and flushing the water system.
- ☐ We are switching to an alternate drinking water source.
- ☐ We are increasing sampling for coliform bacteria to determine the source of the contamination.
- ☐ We are repairing the wellhead seal.
- ☐ We are repairing the storage tank.
- ☐ We are restricting water intake from the river/lake/reservoir to prevent additional bacteria from entering the water system and restricting water use to emergencies.

After Issuing the Notice

Send a copy of each type of notice and a certification that you have met all the public notice requirements to your primacy agency within ten days from the time you issue the notice (40 CFR 141.31(d)).

It is recommended that you notify health professionals in the area of the violation. People may call their doctors with questions about how the violation may affect their health, and the doctors should have the information they need to respond appropriately. In addition, health professionals, including dentists, use tap water during their procedures and need to know of contamination so they can use bottled water.

DRINKING WATER WARNING

[System] water is contaminated with [fecal coliform] or [*E. coli*]

BOIL YOUR WATER BEFORE USING

Fecal coliform [or *E. coli*] bacteria were found in the water supply on [date]. These bacteria can make you sick, and are a particular concern for people with weakened immune systems.

What should I do?

•DO NOT DRINK THE WATER WITHOUT BOILING IT FIRST. Bring all water to a boil, let it boil for one minute, and let it cool before using, or use bottled water. Boiled or bottled water should be used for drinking, making ice, brushing teeth, washing dishes, and food preparation until further notice. Boiling kills bacteria and other organisms in the water.

Fecal coliforms and E. coli are bacteria whose presence indicates that the water may be contaminated with human or animal wastes. Microbes in these wastes can cause diarrhea, cramps, nausea, headaches, or other symptoms. They may pose a special health risk for infants, young children, and people with severely compromised immune systems.

The symptoms above are not caused only by organisms in drinking water. If you experience any of these symptoms and they persist, you may want to seek medical advice. People at increased risk should seek advice about drinking water from their health care providers.

What happened? What is being done?

Bacterial contamination can occur when increased run-off enters the drinking water source (for example, following heavy rains). It can also happen due to a break in the distribution system (pipes) or a failure in the water treatment process.

[Describe corrective action.] We will inform you when tests show no bacteria and you no longer need to boil your water. We anticipate resolving the problem within [estimated time frame].

For more information, please contact [name of contact] at [phone number] or [mailing address]. General guidelines on ways to lessen the risk of infection by microbes are available from the EPA Safe Drinking Water Hotline at 1(800) 426-4791.

Please share this information with all the other people who drink this water, especially those who may not have received this notice directly (for example, people in apartments, nursing homes, schools, and businesses). You can do this by posting this notice in a public place or distributing copies by hand or mail.

This notice is being sent to you by [system]. State Water System ID#: _____.

Date distributed:

Instructions for total coliform Treatment Technique Violation Public Notice

Example on Next Page

Since exceeding a Total Coliform treatment technique is a Tier 2 violation, you must provide public notice to persons served as soon as practical but within 30 days after you learn of the violation (40 CFR 141.203(b)). Persistent total coliform problems can be serious. Some states have more stringent requirements for coliform violations. Check with your primacy agency to make sure you meet all requirements. You must issue a repeat notice every three months for as long as the violation persists.

Community systems must use one of the following methods (40 CFR 141.203(c)):

- ☐ Hand or direct delivery
- ☐ Mail, as a separate notice or included with the bill

Non-community systems must use one of the following methods (40 CFR 141.203(c)):

- ☐ Posting in conspicuous locations
- ☐ Hand delivery
- ☐ Mail

In addition, both community and non-community systems must use another method reasonably calculated to reach others if they would not be reached by the first method (40 CFR 141.203(c)). Such methods could include newspapers, e-mail, or delivery to community organizations. If you mail, post, or hand deliver, print your notice on letterhead, if available. The notice below is appropriate for hand delivery or mail. If you modify the notice, you must still include all the required elements and leave the health effects language in italics unchanged. This language is mandatory (40 CFR 141.205(d)).

Description of the Violation

The description of the violation may vary depending which treatment technique was violated.

Corrective Action

In your notice, describe corrective actions you are taking. Listed below are some steps commonly taken by water systems with treatment technique violations. Use one or more of the following actions if appropriate, or develop your own:

- We have completed the required start-up procedures and provided the appropriate certification to the state. The procedures included [describe what you did, for example, flushed the system, disinfected the system, collected total coliform bacteria samples, etc.].
- We have collected [number] coliform bacteria samples as required and [number] sample results were negative for total coliform bacteria.
- We have begun to correct the sanitary defect(s) identified during an assessment of our water system by taking the following corrective actions: [Describe corrective actions].
- To ensure that our water system is protected against contamination, we are working with the state to implement the following corrective actions: [Describe corrective actions].
- We completed the required assessment and identified the cause of the sanitary defect to be addressed [describe the issue or problem found, for example, damage to the storage tank, a missing vent screen, etc.] We are currently correcting the problem on a schedule approved by [State Department of Public Health].
- We have provided the missing reports to the state and have revised our procedures to ensure we comply with reporting requirements in the future. We are no longer in violation.

Make sure to send a copy of each type of notice and a certification that you have met all the public notice requirements to your primacy agency within ten days after issuing the notice (40 CFR 141.31(d)).

IMPORTANT INFORMATION ABOUT YOUR DRINKING WATER
[Water System Name] Failed to Perform Activities Required to Address Coliform
Bacteria Contamination of the Water System

During recent routine monitoring, our water system tested positive for total coliforms. **Coliforms are bacteria that are naturally present in the environment and are used as an indicator that other, potentially harmful, waterborne pathogens may be present or that a potential pathway exists through which contamination may enter the drinking water distribution system. We found coliforms indicating the need to look for potential problems in water treatment or distribution.*

*When this occurs, we are required to conduct assessments to identify problems and to correct any problems that are found.**
[Describe the TT violation, using the mandatory language of **We failed to conduct the required assessment** by [Enter date the assessment was due] and/or **We failed to correct all identified sanitary defects that were found during the assessment(s)** by [Enter date correction was due].]

As our customers, you have a right to know what happened and what we are doing to correct this situation.

What should I do?

- You do not need to boil your water or take other corrective actions. However, if you have specific health concerns, consult your doctor.
- If you have a severely compromised immune system, are pregnant, or are elderly, you may be at increased risk and should seek advice from your healthcare provider about drinking this water. You should also seek advice from your healthcare provider about using the water if you have an infant. General guidelines on ways to lessen the risk of infection by bacteria and other disease-causing organisms are available from EPA's Safe Drinking Water Hotline at 1-800-426-4791.

What does this mean?

Since total coliform bacteria are generally not harmful themselves, this is not an emergency. If it had been you would have been notified within 24 hours.

Failure to identify and correct the defects has the potential to cause continued distribution system contamination. Inadequately treated or inadequately protected water may contain disease-causing organisms. These organisms can cause symptoms such as diarrhea, nausea, cramps, and associated headaches.

What is being done?

[Describe corrective action including when your water system expects to return to compliance or resolve the violation].

For more information, please contact [name of contact] at [phone number] or [mailing address].

Please share this information with all the other people who drink this water, especially those who may not have received this notice directly (for example, people in apartments, nursing homes, schools, and businesses). You can do this by posting this notice in a public place or distributing copies by hand or mail.

This notice is being sent to you by [water system name]. State Water System ID#: _____.

Date distributed: _____.

Instructions for Monitoring Violations Annual Notice

Example on Next Page

Since most monitoring violations are included in Tier 3, you must provide public notice to persons served within one year after you learn of the violation (40 CFR 141.204(b)). Multiple monitoring violations can be serious, and your primacy agency may have more stringent requirements. Check with your primacy agency to make sure you meet its requirements.

Community systems must use one of the following (40 CFR 141.204(c)):

- ☐ Hand or direct delivery
- ☐ Mail, as a separate notice or included with the bill

Non-community systems must use one of the following (40 CFR 141.204(c)):

- ☐ Posting in conspicuous locations
- ☐ Hand delivery
- ☐ Mail

In addition, both community and non-community systems must use another method reasonably calculated to reach others if they would not be reached by the first method (40 CFR 141.204(c)). Such methods could include newspapers, e-mail, or delivery to community organizations. If you post the notice, it must remain posted until the violation is resolved. If the violation has been resolved, you must post the notice for at least one week (40 CFR 141.204(b)). If you mail, post, or hand deliver, print your notice on letterhead, if available.

The notice below is appropriate for insertion in an annual notice or the CCR, as long as public notification timing and delivery requirements are met (40 CFR 141.204(d)). You may need to modify the template for a notice for individual monitoring violations. This example presents violations in a table; however, you may write out an explanation for each violation if you wish. For any monitoring violation for volatile organic compounds (VOCs) or other groups, you may list the group name in the table, but you must provide the name of every chemical in the group on the notice, e.g., in a footnote.

You may need to modify the notice if you had any monitoring violations for which monitoring later showed a maximum contaminant level or other violation. In such cases, you should refer to the public notice you issued at that time. Include in your notice the standard language for monitoring and testing procedure violations in *italics* (40 CFR 141.205(d)(2)). If you modify the notice, you may not alter this mandatory language.

Corrective Actions

In your notice, describe corrective actions you took or are taking. Listed below are some steps commonly taken by water systems with monitoring violations. Choose the appropriate language, or develop your own:

- ☐ We have since taken the required samples, as described in the last column of the table above. The samples showed we are meeting drinking water standards.
- ☐ We have since taken the required samples, as described in the last column of the table above. The sample for [contaminant] exceeded the limit. [Describe corrective action; use information from public notice prepared for violating the limit.]
- ☐ We plan to take the required samples soon, as described in the last column of the table above.

After Issuing the Notice

Make sure to send your primacy agency a copy of each type of notice and a certification that you have met all the public notice requirements within ten days after issuing the notice (40 CFR 141.31(d)).

IMPORTANT INFORMATION ABOUT YOUR DRINKING WATER
Monitoring Requirements Not Met for [System]

Our water system violated several drinking water standards over the past year. Even though these were not emergencies, as our customers, you have a right to know what happened and what we did to correct these situations.

We are required to monitor your drinking water for specific contaminants on a regular basis. Results of regular monitoring are an indicator of whether or not our drinking water meets health standards. During [compliance period] we ['did not monitor or test' or 'did not complete all monitoring or testing'] for [contaminant(s)] and therefore cannot be sure of the quality of our drinking water during that time.

What should I do?

There is nothing you need to do at this time.

The table below lists the contaminant(s) we did not properly test for during the last year, how often we are supposed to sample for [this contaminant/these contaminants] and how many samples we are supposed to take, how many samples we took, when samples should have been taken, and the date on which follow-up samples were (or will be) taken.

What happened? What is being done?

[Describe corrective action.]

For more information, please contact [name of contact] at [phone number] or [mailing address].

Please share this information with all the other people who drink this water, especially those who may not have received this notice directly (for example, people in apartments, nursing homes, schools, and businesses). You can do this by posting this notice in a public place or distributing copies by hand or mail.

This notice is being sent to you by [system].

State Water System ID#: _____.

Date distributed:

CERTIFICATE OF PUBLIC NOTIFICATION

PWS Name: _____
system name

PWS ID #: _____
system identification number

For Violation: _____
describe violation or situation

Occurring: _____
insert date

The public water system indicated above, hereby affirms that public notice has been provided to consumers in accordance with the delivery, content, and format requirements and deadlines in 40 CFR Part 141, subpart Q.

Consultation with primacy agency (if required) _____
insert date name of KDHE staff contacted

Notice distributed by _____ on _____
insert method **insert date**

Notice distributed by _____ on _____
insert method **insert date**

Attached: Content - 10 required elements. *Copies of all public notice methods used to reach customers are required to accompany this Certificate of Public Notification.*

Signature of PWSS official agent, owner or manager/operator

Date _____

Return to: KDHE Bureau of Water
Public Water Supply Section
1000 SW Jackson; Suite 420
Topeka, KS 66612-1367

Contents of Notice

All public notices must include a clear and readily understandable explanation of each violation or situation and must address the following ten (10) elements:

1. Description of the violation or situation including contaminant(s) of concern and (as applicable) the contaminant level(s);
2. When the violation or situation occurred;
3. Any potential adverse health effects from the violation or situation, using standard language provided in the Rule;
4. The population at risk, including subpopulations particularly vulnerable if exposed to the contaminant in their drinking water;
5. Whether alternate water supplies should be used;
6. What actions consumers should take, including when to seek medical help, if known;
7. What the system is doing to correct the violation or situation;
8. When the system expects to return to compliance or resolve the situation;
9. Contact information: name, business address, and phone number of the water system owner, operator, or designee of the PWS that can provide additional information; and
10. A statement encouraging notice recipients to distribute the notice to other persons served (using standard language from the rule), where applicable.

WATER MAIN DISINFECTION PROCEDURE

1. While laying water main pipe, make sure open ends are plugged to prevent debris and varmints from entering. Install two or three pigs with a concentration of chlorine before and between pigs at the point of potable water supply.
2. After pipe laying is completed and backfill has taken place, the disinfection procedure may begin.
3. Open the valve from the potable water system to flush and remove air. This may be accomplished through a fire hydrant or corporation stop at the far end of the section of new pipe being disinfected. The velocity shall not be less than 2.5 ft/sec.
4. After air and debris are removed by flushing, a pressure test may be run if desired, then HTH chlorine solution is pumped into the section of new water main through a corporation stop. (Amount of HTH to be used can be taken from the corresponding table.)
5. While the HTH solution is being injected into one end of the pipe, the corporation stop at the far end is opened to allow water pressure to carry the chlorine throughout the length of pipe.
6. When the concentration of chlorine has reach 50 mg/l, it is then allowed to remain in the section of new water main for 24 hours. After this, a residual of 25 mg/l (the State recommends at least 10 mg/l) must remain.
7. Then flush the new water main again to allow total replacement of the water with potable water from your system. Again the velocity of flow is greater that 2.5 ft/sec.
8. Before use of the new main, two samples shall be collected 24 hours apart and bacteriological examinations performed (AWWA C651).
9. When the results of this bacteriological examination are received, if negative results are found, the line may be put into use. If positive results are encountered, repeat steps 4-8.

SYNOPSIS OF DISINFECTION PROCEDURE

1. Flush Main..... at least 2.5 ft/sec.
2. Pressure Test..... if applicable
3. Apply Disinfectant..... 50 mg/l for 24 hours
4. Check Cl₂ Residual After 24 hours..... at least 25 mg/L
5. Flush Main..... at least 2.5 ft/sec.
6. Do Preliminary Sampling for Coliform Bacteria Before Putting Line into Service.

VARIOUS METHODS OF WATER MAIN DISINFECTION

1. **SODIUM HYPOCHLORITE** - liquid form (5% - 15% by wt.). Supplied to water plants in glass containers or in rubber-lined steel drums, it is rather unstable and may lose its strength over a period of time.
2. **GASEOUS Cl₂** - 150 lb Chlorine cylinders. Must be kept in an upright position to allow the liquid chlorine to vaporize to a gas, so that only gas passes through the valve. Since the evaporation of the gas results in cooling of the cylinder, the maximum rate of withdrawal from the 150 lb cylinders is 40 lbs/24 hours of chlorine at 70 degrees Fahrenheit. Liquid chlorine will not vaporize when temperature is 50 degrees Fahrenheit or less. Freezing can also take place if the chlorine application is not properly controlled. If a leak takes place, the ditch will fill up with chlorine gas because chlorine is 22 times heavier than air.
3. **CALCIUM HYPOCHLORITE TABLETS** - pellet form, 65% available chlorine. Quite stable, and can be stored for long periods of time with only small losses in strength. Only drawback - requires some time for solution.
4. **CALCIUM HYPOCHLORITE GRANULAR** - powder form. Commercial High Test Hypochlorite (HTH), 65% available chlorine. Very stable and can be stored for extended periods of time. Goes into solution quickly, and forms hypochlorous acid in water.

CALCULATIONS FOR FLOW VELOCITY IN DISINFECTION

Given a section of 8" water main, what flow rate of water is equal to a flow velocity of 2.5 ft/sec?

1. Find cubic feet per second.
 $\text{ft}^3/\text{sec} = \text{velocity, ft/sec} \times \text{diameter, ft} \times \text{diameter, ft} \times 0.785$
2. Find gallons per second.
 $\text{gal/sec} = \text{ft}^3/\text{sec} \times 7.48 \text{ gal/ft}^3$
3. Find gallons per minute.
 $\text{gal/min} = \text{gal/sec} \times 60 \text{ sec/min}$

The total calculation should look like this:

1. Cubic feet per second.
 $\text{ft}^3/\text{sec} = 2.5 \text{ ft/sec} \times 0.667' \times 0.667' \times 0.785$
 $\text{ft}^3/\text{sec} = 0.873$
2. Gallons per second.
 $\text{gal/sec} = 0.873 \text{ ft}^3/\text{sec} \times 7.48 \text{ gal/ft}^3$
 $\text{gal/sec} = 6.53$
3. Gallons per minute.
 $\text{gal/min} = 6.53 \text{ gal/sec} \times 60 \text{ sec/min}$
 $\text{gal/min} = 391.8$

The following table is in gallons per minute for the following main sizes at a velocity of 2.5 ft/sec.

<u>MAIN LINE</u>	<u>GALLONS PER MINUTE</u>
2"	24
4"	96
6"	220
8"	392
10"	606
12"	880

CALCULATION FOR WATER MAIN DISINFECTION

Given a 500' section of 8" water main, how much 65% available HTH is needed to provide an initial application of 50 mg/l?

1. Convert 8" to feet (0.667'). Diameter = 0.667'. Radius = 0.333' (1/2 of diameter)
2. Find cubic feet.
 $\text{ft}^3 = 0.785 \times d^2 \times \text{length}$ or $0.785 \times 0.667 \times 0.667 \times 500'$ or
 $\text{ft}^3 = 3.14 \times r^2 \times \text{length}$ or $3.14 \times 0.333 \times 0.333 \times 500'$
3. Find amount of gallons of water in line.
 $\text{gallons} = \text{ft}^3 \times 7.48 \text{ gallons/ft}^3$
4. Find lbs of 100% available chlorine
 $\text{lbs of 100\% available} = (\text{dose}) \text{ mg/l} \times 8.34 \times \text{gallons}/1,000,000$
5. Find lbs of 65% available chlorine.
 $\text{lbs of 65\% available} = \text{lbs of 100\% available}/0.65 \text{ available}$
6. Find ounces of 65% available chlorine.
 $\text{ounces of 65\% available} = \text{lbs of 65\% available} \times 16 \text{ ozs/lb}$

The total calculation should look like this:

1. Diameter of pipe in feet.
 $8" \text{ divided by } 12 = 0.667$
2. Cubic feet of pipe.
 $\text{ft}^3 = 0.785 \times 0.667 \times 0.667 \times 500' \text{ ft}^3 = 174.5$
3. Gallons of water in line.
 $\text{gallon} = 174.5 \text{ ft}^3 \times 7.48 \text{ gal/ft}^3 \text{ Gallons} = 1305.3$
4. lbs of 100% available chlorine.
 $\text{lbs of 100\% available} = 50 \text{ mg/l} \times 8.34 \times 1305.3/1,000,000$
 $\text{lbs of 100\% available} = 0.5443$

5. lbs of 65% available chlorine.
 lbs of 65% available = 0.5443 100% available/.65 available
 lbs of 65% available = 0.8374

6. Ounces of 65% available chlorine.
 ozs of 65% available = 0.8374 lbs of 65% available x 16 ozs/lb
 ozs of 65% available = 13.4

**TABLE OF DISINFECTION OF WATER MAINS
WITH 65% AVAILABLE HTH IN OUNCES**

Pipe Length, ft	Pipe Diameter, inches						
	2	4	6	8	10	12	16
50	0.084	0.335	0.754	1.341	2.095	3.017	5.364
100	0.168	0.670	1.509	2.682	4.191	6.034	10.728
150	0.251	1.006	2.263	4.023	6.286	9.052	16.092
200	0.335	1.341	3.017	5.364	8.381	12.069	21.456
250	0.419	1.676	3.772	6.705	10.477	15.086	26.820
300	0.503	2.011	4.526	8.046	12.572	18.103	32.184
350	0.587	2.347	5.280	9.387	14.667	21.121	37.548
400	0.670	2.682	6.034	10.728	16.762	24.138	42.912
450	0.754	3.017	6.789	12.069	18.858	27.155	48.276
500	0.838	3.352	7.543	13.410	20.953	30.172	53.640
550	0.922	3.688	8.297	14.751	23.048	33.190	59.004
600	1.006	4.023	9.052	16.092	25.144	36.207	64.368
650	1.090	4.358	9.806	17.433	27.239	39.224	69.732
700	1.173	4.693	10.560	18.774	29.334	42.241	75.096
750	1.257	5.029	11.315	20.115	31.430	45.258	80.460
800	1.341	5.364	12.069	21.456	33.525	48.276	85.823
850	1.425	5.699	12.823	22.797	35.620	51.293	91.187
900	1.509	6.034	13.578	24.138	37.715	54.310	96.551
950	1.592	6.370	14.332	25.479	39.811	57.327	101.915
1000	1.676	6.705	15.086	26.820	41.906	60.345	107.279

First - find the diameter of pipe to be disinfected.

Second - find the number of feet of pipe to be disinfected.

§28-15a-21. Coliform sampling. Each person who operates a public water supply system shall comply with the monitoring and analytical requirements for coliforms contained in 40 CFR 141.21, as in effect on July 1, 2003 and hereby adopted by reference except for §141.21(a)(2) and (a)(3), which are replaced with the following text:

“(a)(2) The sampling period for microbiological compliance shall be one calendar month for all public water supply systems.

“(a)(3) Number of required samples.

“(i) Each public water supply system that uses surface water as its source of supply and serves a population of 4,100 or less shall take a minimum of four water samples each sampling period.

“(ii) Each public water system that uses surface water as its source of supply and serves a population greater than 4,100 shall take water samples according to the schedule prescribed in subsection (a)(3)(iv).

“(iii) Each public water supply system that uses groundwater as its source of supply and each public water supply system that purchases water from another public water supply system shall take water samples according to the schedule specified in paragraph (a)(3)(iv).

“(iv) Each public water supply system shall assure that routine samples are collected at regular time intervals and analyzed for total coliform bacteria as specified in the following table.

<u>Population Served</u>	<u>Minimum number of samples per sampling period</u>
25 to 2,500.....	2
2,501 to 3,300.....	3
3,301 to 4,100.....	4
4,101 to 4,900.....	5
4,901 to 5,800.....	6
5,801 to 6,700.....	7
6,701 to 7,600.....	8
7,601 to 8,500.....	9
8,501 to 12,900.....	10
12,901 to 17,200.....	15
17,201 to 21,500.....	20
21,501 to 25,000.....	25
25,001 to 33,000.....	30
33,001 to 41,000.....	40
41,001 to 50,000.....	50
50,001 to 59,000.....	60
59,001 to 70,000.....	70
70,001 to 83,000.....	80
83,001 to 96,000.....	90
96,001 to 130,000.....	100
130,001 to 220,000.....	120
220,001 to 320,000.....	150
320,001 to 450,000.....	180

For each additional 150,000 in population, an additional 30 water samples shall be analyzed per sampling period.”
(Authorized by and implementing K.S.A. 65-171m; effective Oct. 1, 2004.)

§141.21 Coliform sampling.

(a) *Routine monitoring.* (1) Public water systems must collect total coliform samples at sites which are representative of water throughout the distribution system according to a written sample siting plan. These plans are subject to State review and revision.

(2) ~~The monitoring frequency for total coliforms for community water systems is based on the population served by the system, as follows:~~

~~TOTAL COLIFORM MONITORING FREQUENCY FOR
COMMUNITY WATER SYSTEMS~~

Population served	Minimum number of samples per month
25 to 1,000 [†]	1
1,001 to 2,500.....	2
2,501 to 3,300.....	3
3,301 to 4,100.....	4
4,101 to 4,900.....	5
4,901 to 5,800.....	6
5,801 to 6,700.....	7
6,701 to 7,600.....	8
7,601 to 8,500.....	9
8,501 to 12,900.....	10
12,901 to 17,200.....	15
17,201 to 21,500.....	20
21,501 to 25,000.....	25
25,001 to 33,000.....	30
33,001 to 41,000.....	40
41,001 to 50,000.....	50
50,001 to 59,000.....	60
59,001 to 70,000.....	70
70,001 to 83,000.....	80
83,001 to 96,000.....	90
96,001 to 130,000.....	100
130,001 to 220,000.....	120
220,001 to 320,000.....	150
320,001 to 450,000.....	180
450,001 to 600,000.....	210
600,001 to 780,000.....	240
780,001 to 970,000.....	270
970,001 to 1,230,000.....	300
1,230,001 to 1,520,000.....	330
1,520,001 to 1,850,000.....	360
1,850,001 to 2,270,000.....	390
2,270,001 to 3,020,000.....	420
3,020,001 to 3,960,000.....	450
3,960,001 or more.....	480

~~†Includes public water systems which have at least 15
service connections, but serve fewer than 25 persons.~~

~~If a community water system serving 25 to 1,000 persons has no history of total coliform contamination in its current configuration and a sanitary survey conducted in the past five years shows that the system is supplied solely by a protected groundwater source and is free of sanitary defects, the State may reduce the monitoring frequency specified above, except that in no case may the State reduce the monitoring frequency to less than one sample per quarter. The State must approve the reduced monitoring frequency in writing.~~

(3) ~~The monitoring frequency for total coliforms for non-community water systems is as follows:~~

~~(i) A non-community water system using only ground water (except ground water under the direct influence of surface water, as defined in §141.2) and serving 1,000 persons or fewer must monitor each calendar quarter that the system provides water to the public, except that the State may reduce this monitoring frequency, in writing, if a sanitary survey shows that the system is free of sanitary defects. Beginning June 29, 1994, the State cannot reduce the monitoring frequency for a non-community water system using only ground water (except ground water under the direct influence of surface water, as defined in §141.2) and serving 1,000 persons or fewer to less than once/year.~~

~~(ii) A non-community water system using only ground water (except ground water under the direct influence of surface water, as defined in §141.2) and serving more than 1,000 persons during any month must monitor at the same frequency as a like-sized community water system, as specified in paragraph (a)(2) of this section, except the State may reduce this monitoring frequency, in writing, for any month the system serves 1,000 persons or fewer. The State cannot reduce the monitoring frequency to less than once/year. For systems using ground water under the direct influence of surface water, paragraph (a)(3)(iv) of this section applies.~~

~~(iii) A non-community water system using surface water, in total or in part, must monitor at the same frequency as a like-sized community water system, as specified in paragraph (a)(2) of this section, regardless of the number of persons it serves.~~

~~(iv) A non-community water system using ground water under the direct influence of surface water, as defined in §141.2, must monitor at the same frequency as a like-sized community water system, as specified in paragraph (a)(2) of this section. The system must begin monitoring at this frequency beginning six months after the State determines that the ground water is under the direct influence of surface water.~~

(4) The public water system must collect samples at regular time intervals throughout the month, except that a system which uses only ground water (except ground water under the direct influence of surface water, as defined in §141.2), and serves 4,900 persons or fewer, may collect all required samples on a single day if they are taken from different sites.

(5) A public water system that uses surface water or ground water under the direct influence of surface water, as defined in §141.2, and does not practice filtration in compliance with Subpart H must collect at least one sample near the first service connection each day the turbidity level of the source water, measured as specified in §141.74(b)(2), exceeds 1 NTU. This sample must be analyzed for the presence of total coliforms. When one or more turbidity measurements in any day exceed 1 NTU, the system must collect this coliform sample within 24 hours of the first exceedance, unless the State determines that the system, for logistical reasons outside the system's control, cannot have the sample analyzed within 30 hours of collection. Sample results from this coliform monitoring must be included in determining compliance with the MCL for total coliforms in §141.63.

(6) Special purpose samples, such as those taken to determine whether disinfection practices are sufficient following pipe placement, replacement, or repair, shall not be used to determine compliance with the MCL for total coliforms in §141.63. Repeat samples taken pursuant to paragraph (b) of this section are not considered special purpose samples, and must be used to determine compliance with the MCL for total coliforms in §141.63.

(b) *Repeat monitoring.* (1) If a routine sample is total coliform-positive, the public water system must collect a set of repeat samples within 24 hours of being notified of the positive result. A system which collects more than one routine sample/month must collect no fewer than three repeat samples for each total coliform-positive sample found. A system which collects one routine sample/month or fewer must collect no fewer than four repeat samples for each total coliform-positive sample found. The State may extend the 24-hour limit on a case-by-case basis if the system has a logistical problem in collecting the repeat samples within 24 hours that is beyond its control. In the case of an extension, the State must specify how much time the system has to collect the repeat samples.

(2) The system must collect at least one repeat sample from the sampling tap where the original total coliform-positive sample was taken, and at least one repeat sample at a tap within five service connections upstream and at least one repeat sample at a tap within five service connections downstream of the original sampling site. If a total coliform-positive sample is at the end of the distribution system, or one away from the end of the distribution system, the State may waive the requirement to collect at least one repeat sample upstream or downstream of the original sampling site.

(3) The system must collect all repeat samples on the same day, except that the State may allow a system with a single service connection to collect the required set of repeat samples over a four-day period or to collect a larger volume repeat sample(s) in one or more sample containers of any size, as long as the total volume collected is at least 400 ml (300 ml for systems which collect more than one routine sample/month).

(4) If one or more repeat samples in the set is total coliform-positive, the public water system must collect an additional set of repeat samples in the manner specified in paragraphs (b)(1)-(3) of this section. The additional samples must be collected within 24 hours of being notified of the positive result, unless the State extends the limit as provided in paragraph (b)(1) of this section. The system must repeat this process until either total coliforms are not detected in one complete set of repeat samples or the system determines that the MCL for total coliforms in §141.63 has been exceeded and notifies the State.

(5) If a system collecting fewer than five routine samples/month has one or more total coliform-positive samples and the State does not invalidate the sample(s) under paragraph (c) of this section, it must collect at least five routine samples during the next month the system provides water to the public, except that the State may waive this requirement if the conditions of paragraph (b)(5) (i) or (ii) of this section are met. The State cannot waive the requirement for a system to collect repeat samples in paragraphs (b)(1)-(4) of this section.

(i) The State may waive the requirement to collect five routine samples the next month the system provides water to the public if the State, or an agent approved by the State, performs a site visit before the end of the next month the system provides water to the public. Although a sanitary survey need not be performed, the site visit must be sufficiently detailed to allow the State to determine whether additional monitoring and/or any corrective action is needed. The State cannot approve an employee of the system to perform this site visit, even if the employee is an agent approved by the State to perform sanitary surveys.

(ii) The State may waive the requirement to collect five routine samples the next month the system provides water to the public if the State has determined why the sample was total coliform-positive and establishes that the system has corrected the problem or will correct the problem before the end of the next month the system serves water to the public. In this case, the State must document this decision to waive the following month's additional monitoring requirement in writing, have it approved and signed by the supervisor of the State official who recommends such a decision, and make this document available to EPA and the public. The written documentation must describe the specific cause of the total coliform-positive sample and what action the system has taken and/or will take to correct this problem. The State cannot waive the requirement

to collect five routine samples the next month the system provides water to the public solely on the grounds that all repeat samples are total coliform-negative. Under this paragraph, a system must still take at least one routine sample before the end of the next month it serves water to the public and use it to determine compliance with the MCL for total coliforms in §141.63, unless the State has determined that the system has corrected the contamination problem before the system took the set of repeat samples required in paragraphs (b)(1) through (4) of this section, and all repeat samples were total coliform-negative.

(6) After a system collects a routine sample and before it learns the results of the analysis of that sample, if it collects another routine sample(s) from within five adjacent service connections of the initial sample, and the initial sample, after analysis, is found to contain total coliforms, then the system may count the subsequent sample(s) as a repeat sample instead of as a routine sample.

(7) Results of all routine and repeat samples not invalidated by the State must be included in determining compliance with the MCL for total coliforms in §141.63.

(c) *Invalidation of total coliform samples.* A total coliform-positive sample invalidated under this paragraph (c) does not count towards meeting the minimum monitoring requirements of this section.

(1) The State may invalidate a total coliform-positive sample only if the conditions of paragraph (c)(1) (i), (ii), or (iii) of this section are met.

(i) The laboratory establishes that improper sample analysis caused the total coliform-positive result.

(ii) The State, on the basis of the results of repeat samples collected as required by paragraphs (b)(1) through (4) of this section, determines that the total coliform-positive sample resulted from a domestic or other non-distribution system plumbing problem. The State cannot invalidate a sample on the basis of repeat sample results unless all repeat sample(s) collected at the same tap as the original total coliform-positive sample are also total coliform-positive, and all repeat samples collected within five service connections of the original tap are total coliform-negative (e.g., a State cannot invalidate a total coliform-positive sample on the basis of repeat samples if all the repeat samples are total coliform-negative, or if the public water system has only one service connection).

(iii) The State has substantial grounds to believe that a total coliform-positive result is due to a circumstance or condition which does not reflect water quality in the distribution system. In this case, the system must still collect all repeat samples required under paragraphs (b)(1)-(4) of this section, and use them to determine compliance with the MCL for total coliforms in §141.63. To invalidate a total coliform-positive sample under this paragraph, the decision with the rationale for the decision must be documented in writing, and approved and signed by the supervisor of the State official who recommended the decision. The State must make this document available to EPA and the public. The written documentation must state the specific cause of the total coliform-positive sample, and what action the system has taken, or will take, to correct this problem. The State may not invalidate a total coliform-positive sample solely on the grounds that all repeat samples are total coliform-negative.

(2) A laboratory must invalidate a total coliform sample (unless total coliforms are detected) if the sample produces a turbid culture in the absence of gas production using an analytical method where gas formation is examined (e.g., the Multiple-Tube Fermentation Technique), produces a turbid culture in the absence of an acid reaction in the Presence-Absence (P-A) Coliform Test, or exhibits confluent growth or produces colonies too numerous to count with an analytical method using a membrane filter (e.g., Membrane Filter Technique). If a laboratory invalidates a sample because of such interference, the system must collect another sample from the same location as the original sample within 24 hours of being notified of the interference problem, and have it analyzed for the presence of total coliforms. The system must continue to

re-sample within 24 hours and have the samples analyzed until it obtains a valid result. The State may waive the 24-hour time limit on a case-by-case basis.

(d) *Sanitary surveys.* (1) (i) Public water systems which do not collect five or more routine samples/month must undergo an initial sanitary survey by June 29, 1994, for community public water systems and June 29, 1999, for non-community water systems. Thereafter, systems must undergo another sanitary survey every five years, except that non-community water systems using only protected and disinfected ground water, as defined by the State, must undergo subsequent sanitary surveys at least every ten years after the initial sanitary survey. The State must review the results of each sanitary survey to determine whether the existing monitoring frequency is adequate and what additional measures, if any, the system needs to undertake to improve drinking water quality.

(ii) In conducting a sanitary survey of a system using ground water in a State having an EPA-approved wellhead protection program under section 1428 of the Safe Drinking Water Act, information on sources of contamination within the delineated wellhead protection area that was collected in the course of developing and implementing the program should be considered instead of collecting new information, if the information was collected since the last time the system was subject to a sanitary survey.

(2) Sanitary surveys must be performed by the State or an agent approved by the State. The system is responsible for ensuring the survey takes place.

(e) *Fecal coliforms/Escherichia coli (E. coli) testing.* (1) If any routine or repeat sample is total coliform-positive, the system must analyze that total coliform-positive culture medium to determine if fecal coliforms are present, except that the system may test for *E. coli* in lieu of fecal coliforms. If fecal coliforms or *E. coli* are present, the system must notify the State by the end of the day when the system is notified of the test result, unless the system is notified of the result after the State office is closed, in which case the system must notify the State before the end of the next business day.

(2) The State has the discretion to allow a public water system, on a case-by-case basis, to forgo fecal coliform or *E. coli* testing on a total coliform-positive sample if that system assumes that the total coliform-positive sample is fecal coliform-positive or *E. coli*-positive. Accordingly, the system must notify the State as specified in paragraph (e)(1) of this section and the provisions of §141.63(b) apply.

(f) *Analytical methodology.* (1) The standard sample volume required for total coliform analysis, regardless of analytical method used, is 100 ml.

(2) Public water systems need only determine the presence or absence of total coliforms; a determination of total coliform density is not required.

(3) Public water systems must conduct total coliform analyses in accordance with one of the analytical methods in the following table.

Organism	Methodology ¹²	Citation ¹
Total Coliforms ²	Total Coliform Fermentation Technique ^{3,4,5} Total Coliform Membrane Filter Technique ⁶ Presence-Absence (P-A) Coliform Test ^{5,7} ONPG-MUG Test ⁸ Colisure Test. ⁹ E*Colite® Test. ¹⁰ m-ColiBlue24® Test. ¹¹ Readycult® Coliforms 100 Presence/Absence Test. ¹³ Membrane Filter Technique using Chromocult® Coliform Agar. ¹⁴ Colitag® Test. ¹⁵	9221A, B. 9222A, B, C. 9221D. 9223.

The procedures shall be done in accordance with the documents listed below. The incorporation by reference of the following documents listed in footnotes 1, 6, 8, 9, 10, 11, 13, 14 and 15 was approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR Part 51. Copies of the documents may be obtained from the sources listed below. Information regarding obtaining these documents can be obtained from the Safe Drinking Water Hotline at 800-426-4791. Documents may be inspected at EPA's Drinking Water Docket, EPA West, 1301 Constitution Avenue, NW., EPA West, Room B102, Washington DC 20460 (Telephone: 202-566-2426); or at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, call 202-741-6030, or go to:

http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html

¹ *Standard Methods for the Examination of Water and Wastewater*, 18th edition (1992), 19th edition (1995), or 20th edition (1998). American Public Health Association, 1015 Fifteenth Street, NW, Washington, DC 20005. The cited methods published in any of these three editions may be used. In addition, the following online versions may also be used: 9221 A, B, D-99, 9222 A, B, C-97, and 9223 B-97. Standard Methods Online are available at <http://www.standardmethods.org>. The year in which each method was approved by the Standard Methods Committee is designated by the last two digits in the method number. The methods listed are the only Online versions that may be used.

² The time from sample collection to initiation of analysis may not exceed 30 hours. Systems are encouraged but not required to hold samples below 10 deg. C during transit.

³ Lactose broth, as commercially available, may be used in lieu of lauryl tryptose broth, if the system conducts at least 25 parallel tests between this medium and lauryl tryptose broth using the water normally tested, and this comparison demonstrates that the false-positive rate and false-negative rate for total coliform, using lactose broth, is less than 10 percent.

⁴ If inverted tubes are used to detect gas production, the media should cover these tubes at least one-half to two-thirds after the sample is added.

⁵ No requirement exists to run the completed phase on 10 percent of all total coliform-positive confirmed tubes.

⁶ MI agar also may be used. Preparation and use of MI agar is set forth in the article, "New medium for the simultaneous detection of total coliform and *Escherichia coli* in water" by Brenner, K.P., et. al., 1993, Appl. Environ. Microbiol. 59:3534-3544. Also available from the Office of Water Resource Center (RC-4100T), 1200 Pennsylvania Avenue, NW., Washington, DC 20460, EPA/600/J-99/225. Verification of colonies is not required.

⁷ Six-times formulation strength may be used if the medium is filter-sterilized rather than autoclaved.

⁸ The ONPG-MUG Test is also known as the Autoanalysis Collect System.

⁹ A description of the Colisure Test, Feb 28, 1994, may be obtained from IDEXX Laboratories, Inc., One IDEXX Drive, Westbrook, Maine 04092. The Colisure Test may be read after an incubation time of 24 hours.

¹⁰ A description of the E*Colite® Test, "Presence/Absence for Coliforms and *E. Coli* in Water," Dec 21, 1997, is available from Charm Sciences, Inc., 36 Franklin Street, Malden, MA 02148-4120.

¹¹ A description of the m-ColiBlue24® Test, Aug 17, 1999, is available from the Hach Company, 100 Dayton Avenue, Ames, IA 50010.

¹² EPA strongly recommends that laboratories evaluate the false-positive and negative rates for the method(s) they use for monitoring total coliforms. EPA also encourages laboratories to establish false-positive and false-negative rates within their own laboratory and sample matrix (drinking water or source water) with the intent that if the method they choose has an unacceptable false-positive or negative rate, another method can be used. The Agency suggests that laboratories perform these studies on a minimum of 5% of all total coliform-positive samples, except for those methods where verification/confirmation is already required, e.g., the M-Endo and LES Endo Membrane Filter Tests, Standard Total Coliform Fermentation Technique, and Presence-Absence Coliform Test. Methods for establishing false-positive and negative-rates may be based on lactose fermentation, the rapid test for β -galactosidase and cytochrome oxidase, multi-test identification systems, or equivalent confirmation tests. False-positive and false-negative information is often available in published studies and/or from the manufacturer(s).

¹³ The ReadyCult® Coliforms 100 Presence/Absence Test is described in the document, “ReadyCult® Coliforms 100 Presence/Absence Test for Detection and Identification of Coliform Bacteria and *Escherichia coli* in Finished Waters”, November 2000, Version 1.0, available from EM Science (an affiliate of Merck KGaA, Darmstadt Germany), 480 S. Democrat Road, Gibbstown, NJ 08027-1297. Telephone number is (800) 222-0342, e-mail address is: adellenbusch@emscience.com.

¹⁴ Membrane Filter Technique using Chromocult® Coliform Agar is described in the document, “Chromocult® Coliform Agar Presence/Absence Membrane Filter Test Method for Detection and Identification of Coliform Bacteria and *Escherichia coli* in Finished Waters”, November 2000, Version 1.0, available from EM Science (an affiliate of Merck KGaA, Darmstadt Germany), 480 S. Democrat Road, Gibbstown, NJ 08027-1297. Telephone number is (800) 222-0342, e-mail address is: adellenbusch@emscience.com.

¹⁵ Colitag® product for the determination of the presence/absence of total coliforms and *E. coli* is described in “Colitag® Product as a Test for Detection and Identification of Coliforms and *E. coli* Bacteria in Drinking Water and Source Water as Required in National Primary Drinking Water Regulations,” August 2001, available from CPI International, Inc., 5580 Skylane Blvd., Santa Rosa, CA, 95403, telephone (800) 878-7654, Fax (707) 545-7901, Internet address <http://www.cpiinternational.com>.

(4) [Reserved]

(5) Public water systems must conduct fecal coliform analysis in accordance with the following procedure. When the MTF Technique or Presence-Absence (PA) Coliform Test is used to test for total coliforms, shake the lactose-positive presumptive tube or P-A vigorously and transfer the growth with a sterile 3-mm loop or sterile applicator stick into brilliant green lactose bile broth and EC medium to determine the presence of total and fecal coliforms, respectively. For EPA-approved analytical methods which use a membrane filter, transfer the total coliform-positive culture by one of the following methods: remove the membrane containing the total coliform colonies from the substrate with a sterile forceps and carefully curl and insert the membrane into a tube of EC medium (the laboratory may first remove a small portion of selected colonies for verification), swab the entire membrane filter surface with a sterile cotton swab and transfer the inoculum to EC medium (do not leave the cotton swab in the EC medium), or inoculate individual total coliform-positive colonies into EC Medium. Gently shake the inoculated tubes of EC medium to insure adequate mixing and incubate in a waterbath at 44.5 ± 0.2 °C for 24 ± 2 hours. Gas production of any amount in the inner fermentation tube of the EC medium indicates a positive fecal coliform test. The preparation of EC medium is described in Method 9221E (paragraph 1a) in Standard Methods for the Examination of Water and Wastewater, 18th edition (1992), 19th edition (1995), and 20th edition (1998); the cited method in any one of these three editions may be used. Public water systems need only determine the presence or absence of fecal coliforms; a determination of fecal coliform density is not required.

(6) Public water systems must conduct analysis of *Escherichia coli* in accordance with one of the following analytical methods:

(i) EC medium supplemented with 50 µg/mL of 4-methylumbelliferyl-beta-D-glucuronide (MUG) (final concentration), as described in Method 9222G in Standard Methods for the Examination of Water and Wastewater, 19th edition (1995) and 20th edition (1998). Either edition may be used. Alternatively, the 18th edition (1992) may be used if at least 10 mL of EC medium, as described in paragraph (f) (5) of this section, is supplemented with 50 µg/mL of MUG before autoclaving. The inner inverted fermentation tube may be omitted. If the 18th edition is used, apply the procedure in paragraph (f) (5) of this section for transferring a total coliform-positive culture to EC medium supplemented with MUG, incubate the tube at 44.5 ± 0.2 °C for 24 ± 2 hours, and then observe fluorescence with an ultraviolet light (366 nm) in the dark. If fluorescence is visible, *E. coli* are present.

(ii) Nutrient agar supplemented with 100 µg/mL of 4-methylumbelliferyl-beta-D-glucuronide (MUG) (final concentration), as described in Method 9222G in Standard Methods for the Examination of Water and Wastewater, 19th edition (1995) and 20th edition (1998). Either edition may be used for determining if a total coliform-positive sample, as determined by a membrane filter technique, contains *E. coli*.

Alternatively, the 18th edition (1992) may be used if the membrane filter containing a total coliform-positive colony(ies) is transferred to nutrient agar, as described in Method 9221B (paragraph 3) of Standard Methods (18th edition), supplemented with 100 µg/mL of MUG. If the 18th edition is used, incubate the agar plate at 35 °C for 4 hours and then observe the colony(ies) under ultraviolet light (366 nm) in the dark for fluorescence. If fluorescence is visible, *E. coli* are present.

(iii) Minimal Medium ONPG-MUG (MMO-MUG) Test, as set forth in the article "National Field Evaluation of a Defined Substrate Method for the Simultaneous Detection of Total Coliforms and *Escherichia coli* from Drinking Water: Comparison with Presence-Absence Techniques" (Edberg et al.), Applied and Environmental Microbiology, Volume 55, pp. 1003-1008, April 1989. (Note: The Autoanalysis Colilert System is an MMO-MUG test). If the MMO-MUG test is total coliform-positive after a 24-hour incubation, test the medium for fluorescence with a 366-nm ultraviolet light (preferably with a 6-watt lamp) in the dark. If fluorescence is observed, the sample is *E. coli*-positive. If fluorescence is questionable (cannot be definitively read) after 24 hours incubation, incubate the culture for an additional four hours (but not to exceed 28 hours total), and again test the medium for fluorescence. The MMO-MUG Test with hepes buffer in lieu of phosphate buffer is the only approved formulation for the detection of *E. coli*.

(iv) The Colisure Test. A description of the Colisure Test may be obtained from the Millipore Corporation, Technical Services Department, 80 Ashby Road, Bedford, MA 01730.

(v) The membrane filter method with MI agar, a description of which is cited in footnote 6 to the table in paragraph (f)(3) of this section.

(vi) E*Colite[®] Test, a description of which is cited in footnote 10 to the table at paragraph (f)(3) of this section.

(vii) m-ColiBlue24[®] Test, a description of which is cited in footnote 11 to the table in paragraph (f)(3) of this section.

(viii) Readycult[®] Coliforms 100 Presence/Absence Test, a description of which is cited in footnote 13 to the table at paragraph (f)(3) of this section.

(ix) Membrane Filter Technique using Chromocult[®] Coliform Agar, a description of which is cited in footnote 14 to the table at paragraph (f)(3) of this section.

(7) As an option to paragraph (f)(6) (iii) of this section, a system with a total coliform-positive, MUG-negative, MMO-MUG test may further analyze the culture for the presence of *E. coli* by transferring a 0.1 ml, 28-hour MMO-MUG culture to EC Medium + MUG with a pipet. The formulation and incubation conditions of EC Medium + MUG, and observation of the results are described in paragraph (f)(6) (i) of this section.

(8) The following materials are incorporated by reference in this section with the approval of the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. Copies of the analytical methods cited in Standard Methods for the Examination of Water and Wastewater (18th, 19th, and 20th editions) may be obtained from the American Public Health Association *et al.*; 1015 Fifteenth Street, NW., Washington, DC 20005-2605. Copies of the MMO-MUG Test, as set forth in the article "National Field Evaluation of a Defined Substrate Method for the Simultaneous Enumeration of Total Coliforms and *Escherichia coli* from Drinking Water: Comparison with the Standard Multiple Tube Fermentation Method" (Edberg *et al.*) may be obtained from the American Water Works Association Research Foundation, 6666 West Quincy Avenue, Denver, CO 80235. Copies of the MMO-MUG Test as set forth in the article

"National Field Evaluation of a Defined Substrate Method for the Simultaneous Enumeration of Total Coliforms and *Escherichia coli* from Drinking Water: Comparison with the Standard Multiple Tube Fermentation Method" (Edberg *et al.*) may be obtained from the American Water Works Association Research Foundation, 6666 West Quincy Avenue, Denver, CO 80235. A description of the Colisure Test may be obtained from the Millipore Corp., Technical Services Department, 80 Ashby Road, Bedford, MA 01730. Copies may be inspected at EPA's Drinking Water Docket; 401 M St., SW.; Washington, DC 20460, or at the Office of the Federal Register; 800 North Capitol Street, NW., suite 700, Washington, DC.

(g) *Response to violation.* (1) A public water system which has exceeded the MCL for total coliforms in §141.63 must report the violation to the State no later than the end of the next business day after it learns of the violation, and notify the public in accordance with subpart Q.

(2) A public water system which has failed to comply with a coliform monitoring requirement, including the sanitary survey requirement, must report the monitoring violation to the State within ten days after the system discovers the violation, and notify the public in accordance with subpart Q.

[54 FR 27562, June 29, 1989, as amended at 54 FR 30001, July 17, 1989; 55 FR 25064, June 19, 1990; 56 FR 642, Jan. 8, 1991; 57 FR 1852, Jan. 15, 1992; 57 FR 24747, June 10, 1992; 59 FR 62466, Dec. 5, 1994; 60 FR 34085, June 29, 1995; 64 FR 67461, Dec. 1, 1999; 65 FR 26022, May 4, 2000; 67 FR 65246, Oct. 23, 2002; 67 FR 65896, Oct. 29, 2002]

§141.33 Record maintenance.

Any owner or operator of a public water system subject to the provisions of this part shall retain on its premises or at a convenient location near its premises the following records:

(a) Records of bacteriological analyses made pursuant to this part shall be kept for not less than 5 years. Records of chemical analyses made pursuant to this part shall be kept for not less than 10 years. Actual laboratory reports may be kept, or data may be transferred to tabular summaries, provided that the following information is included:

- (1) The date, place, and time of sampling, and the name of the person who collected the sample;
- (2) Identification of the sample as to whether it was a routine distribution system sample, check sample, raw or process water sample or other special purpose sample;
- (3) Date of analysis;
- (4) Laboratory and person responsible for performing analysis;
- (5) The analytical technique/method used; and
- (6) The results of the analysis.

(b) Records of action taken by the system to correct violations of primary drinking water regulations shall be kept for a period not less than 3 years after the last action taken with respect to the particular violation involved.

(c) Copies of any written reports, summaries or communications relating to sanitary surveys of the system conducted by the system itself, by a private consultant, or by any local, State or Federal agency, shall be kept for a period not less than 10 years after completion of the sanitary survey involved.

(d) Records concerning a variance or exemption granted to the system shall be kept for a period ending not less than 5 years following the expiration of such variance or exemption.

(e) Copies of public notices issued pursuant to Subpart Q of this part and certifications made to the primacy agency pursuant to §141.31 must be kept for three years after issuance.

[40 FR 59570, Dec. 24, 1975, as amended at 65 FR 26022, May 4, 2000]

§ 28-15-19. Disinfection of drinking water. (a) All drinking water supplied to the public from a public water supply system shall be disinfected.

(b) When chlorination is employed, a sufficient amount of chlorine shall be added to the water to maintain a distribution system chlorine residual of at least 0.2 mg/l of free chlorine or 1.0 mg/l of combined chlorine.

(1) Failure to maintain a residual as specified above in more than five percent of measurements taken each month, in any two consecutive months shall be deemed a violation of this regulation.

(2) Each day the public water supply system serves water to its customers, the operator shall make a determination of the chlorine residual. The data shall be recorded in such a manner that the department can determine whether the requirements of this rule and regulation have been met. (Authorized by and implementing K.S.A. 65-171m; effective May 1, 1982; amended Sept. 26, 1994.)